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INFLUENCE OF DIFFERENT INTENSITY RESISTANCE TRAINING ON SELECTED SPEED PARAMETERS

DR. R. SAVARIRAJAN[a]

[a]Director of Physical Education, Arignar Anna Govt. Arts & Science College, Karaikal, Puducherry 609605, India
**Corresponding Author Ph: 04368- 230431; Email:* savariphd@yahoo.com

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ABSTRACT

The purpose of the study was to examine the influence of different intensity resistance training on selected speed parameters. To achieve this, sixty men students of bachelor's degree were selected as subjects at random. The selected subjects were divided into four groups of fifteen subjects each namely, high velocity resistance training followed by speed training group, medium velocity resistance training followed by speed training group, low velocity resistance training followed by speed training group and control group. The experimental groups were trained for four non-alternative days in a week for twelve weeks. Speed, Stride Length and Stride Frequency were selected as criterion variables. The collected data were analyzed statistically by using dependent _t'– test to determine the improvements, if any, among the groups; and analysis of covariance (ANCOVA) was used to determine the differences, if any, among the adjusted post-test means on selected dependent variables, separately. The results of the study indicate that the experimental groups have significantly improved on speed, stride length and stride frequency and also indicate that the speed parameters showed significant difference between high velocity resistance training followed by speed training group, medium velocity resistance training followed by speed training group and low velocity resistance training followed by speed training group. It is also found that the improvement caused by high velocity resistance training followed by speed training was greater when compared to the effects caused by both medium and low velocity resistance training followed by speed training.

Key Words: Resistance, high velocity resistance, ANCOVA, Speed

INTRODUCTION

Sports in the present world has become extremely competitive. It is not the mere participation or practice that brings out victory to an individual. Therefore, sports life is affected by various factors, like Physiology, Biomechanics, Sports Training, Sports Medicine, Sociology and Psychology etcetera. All the coaches, trainers, physical education personnels and doctors are doing their best to improve the performance of the players of their country. Athlete / Player of all the countries are also trying hard to bring laurels / medals for their countries in International Competitions [1]. Sports training is done for improving sports performance. The sports performance as any other type of human performance, is not the product of single system or aspect of human personality. On the contrary, it is the product of the total personality of the sports person. The personality of a person has several dimensions e.g. physical, physiological, social and psychic. In order to improve sports performance, the social and psychic capacities of the sports person also have to be improved in addition to the physical and physiological ones. In other words, the total personality of a sportsman has to be improved in order to enhance his performance. Sport's training, therefore, directly and indirectly aims at improving the personality of the sportsman. No wonder, therefore, sports training is an educational process [2]. Scientific training methods and application of basic principles of body mechanics in sports skill have been attributed to the higher level of performance in sports skills performance is the combined result of co-ordinated exertion and integration of a variety of functions. Genetic factor probably plays an important role in an individual's performance. It appears that upto seventy percent of an individual's maximal force, power or capacity is a matter of genetic factor. The environments as well as geographic location too play an important role in performance. Moreover performance to a certain extent depends upon the physical and motor fitness qualities in which definite improvement can be achieved through appropriate training [3]. According to **Fox** sports training is a programme of exercise designed to improve the skills and increase the energy capacities of an athlete for a particular event [4]. These basic training procedures will serve better when utilized with modifications suited to individuals or a group dealt with. The training programme should look into improving the performance of the athletes and at the same time should prevent injury from taking place. Sports training is a basic preparation for better performance through physical exercise. It is based on scientific principles of aiming at education and performance enhancement. Sports activities consist of motor movement and action and their success depends to a great extent on how correctly they are performed. Techniques of training and improvement of tactical efficiency

play a vital role in a training process. Resistance training is an anaerobic form of exercise. This training programme can be used to enhance the ability of the body to perform at very high force and / or power outputs for a very short period of time to improve the ability of the body to perform repeated bouts of maximal activity. The importance of resistance training to sports performance has been supported by studies which have demonstrated that resistance training in the form of weight training and more recently, plyometric training have enchanced some competitive performances. Most typically this has been reported as an improvement in vertical jumping ability. Many studies have reported that resistance training has enhanced muscular strength, but failed to induce changes in dynamic sporting performance. Over the past 20 years, the use of resistance training has progressed from an activity performed by relatively few strength athletes to a permanent feature of the training routines of most sportspersons. Although there is a variety of resistance training methods one can use to enhance muscular power. During the past two decades, speed training programmes have been successfully developed for several sports in which running is a basic skill. More recently however, coaches who have athletes in other sports have been using similar methods to increase the speed of their performers, with very good results. Speed training, like strength, flexibility and mental skills training has now become an important ingredient in the total programme, particularly where speed of movement is essential in the sport. The aim of speed training is to condition the athlete to move at high velocity, employing maximal power when needed. In order to do this, the neuromuscular system must be conditioned to very fast movements and training need to be very specific, with a very high anaerobic component. If an athlete is to reach full potential in a sport and if speed of movement is a necessary component, the speed and velocity demands of the sport must be carefully analyzed [5]. Speed is one of the most important physical qualities required for successful performance in jumps, especially in the horizontal jump and in the pole vault. The amount of speed required is slightly different in the event due to differing emphasis in the take off. It is said that sprinters are born not made and it is certainly true that natural ability will always play a major role in sports events. However, the standard is high and the competition is so fierce at present that no sprinter can achieve real success without correct techniques and proper training. It has been established that running speed can be improved through training. **Eicher** is of the opinion that speed is the product of two factors, stride length and stride frequency [6]. Increasing either factor automatically increases a runner‘s sprinting speed. From training point of view, it appears that the stride length can be increased by increasing the leg strength. Though stride frequency is an inborn quality, it might be possible to improve slightly through training. It appears that this improvement also brings about a corresponding shortening of stride length. In stride frequency, time becomes our concern. When we reduce the time necessary to apply force at take off and eliminate wasted time in the air, then stride frequency will improve. Stride frequency is the time required to complete a stride and is limited by the length of the stride. Thus, although stride length is determined when force is applied by pushing against the ground, stride frequency is merely the time required to complete that stride. Again, maximum speed is achieved when stride length and stride frequency are in correct proportion [7]. The relationship between strength and speed is well known. Speed performance can be improved rapidly by improving the explosive strength of the concerned muscle groups. A decrease in strength always has negative effect on speed performance. Because of the importance of explosive strength and its high trainability most of the times, speed performance is improved by improving explosive strength. Explosive strength further depends on muscle co-ordination. It also depends on metabolic process. Except muscle composition, all other factors can be improved through training **[2]**.

METHODOLOGY

In this context, the investigator made an attempt to analyze the effect of three different intensity resistance training on motor fitness. The purpose of the present investigation was to find out the influence of different intensity resistance training on selected speed parameters such as speed, stride length and stride frequency. To achieve the purpose of this study, sixty men students studying bachelor‘s degree course in the department of physical education and sports sciences, Annamalai University, Annamalai Nagar, Tamil Nadu were randomly selected as subjects. The subjects were divided into four groups namely high velocity resistance training followed by speed training group, medium velocity resistance training followed by speed training group, low velocity resistance training followed by speed training group and control group of fifteen subjects each. The experimental groups were trained for four non-alternative days in a week for twelve weeks.The control group who were not engaged in any special activities other than their regular curricular activities during the period of training. Among the speed parameters, the following variables were selected as criterion variables namely speed, stride length and stride frequency. All the subjects were tested on selected criterion variables prior to and immediately after the training period. Speed was assessed by 50mts run, stride length and stride frequency was assessed by Videograph. The collected data were analyzed statistically by using ‗t‘- test to determine the differences, if any, among the groups prior to and immediately after the training period on selected criterion variables separately. Analysis of Covariance (ANCOVA) was used to determine the differences, if any, among the adjusted post test means on selected dependent variables separately. Whenever the ‗F‘ ratio for adjusted post test was found to be significant, the Scheffe‘s test was applied as post-hoc test to find out paired mean differences. The level of significance was fixed at .05 level of confidence, which was considered as appropriate.

RESULT AND DISCUSSION

The investigator explained the purpose of training programme to the subjects and their part in the study. For the collection of data, the investigator explained the procedure of testing on selected dependent variables and gave instructions about the procedure to be adopted by them for measuring. Five sessions were spent to familiarize the subjects with the technique involved to execute the resistance training and speed training exercises. It helped them to perform the resistance training and speed training exercises perfectly and avoid injuries. Further, the control group was specially oriented, advised and controlled to avoid the special practice of any of the specific training programme till the end of the experimental period. The subjects of all the groups were sufficiently motivated to perform their maximal level during testing periods.A pilot study was conducted to assess the initial capacity of the subjects to fix the load and also to design the training programme. For that purpose, ten men subjects were selected at random and they were given different kinds of resistance training in the form of weight and plyometric exercises under the watchful eyes of the investigator. During the pilot study, the subjects underwent many weight training and plyometric exercises and only limited exercises which are very closely related to develop the dependent variables were located and selected to design the training programme. The initial loads of the subjects were fixed based on the results of the pilot study **[8]**.

The training load and programme were fixed for varied velocity resistance training and speed training respectively. While constructing the training programmes the basic principles of sports training (progression of overload and specificity) were followed. During construction of the training programme, the individual differences were also be considered. During the training period, the experimental groups underwent their respective training programmes in addition to their regular physical education programme of the course of study as per their curriculum. Group I underwent high velocity resistance training followed by speed training, group II underwent medium velocity resistance training followed by speed training and group III underwent low velocity resistance training followed by speed training for four non-alternative days in a week for twelve weeks.The duration of training session in all the days were between one hour to one and half hour approximately which included warming up and limbering down. Group IV acted as control who did not participate in any specific training on par with experimental groups. However, they performed the regular physical education programme of the course of study. All the subjects involved in this study were carefully monitored throughout the training programme to be away from injuries. They were questioned about their health status throughout the training programme. None of them reported with any injuries. However, muscle soreness appeared in the earlier period of the training programme and was reduced in due course. Before the commencement of the experimentation, the investigator recorded the 1 RM for each subject separately for three experimental groups. 1 RM was taken for each subject. The experimental group I, II and III performed the weight and plyometric training at different velocity. The velocity zone was fixed at high, medium and low [9-12]. High velocity represents 90-100%, medium velocity represents 70-80% and low velocity represents 30- 50% of load and intensity. However, the experimental group I, II and III performed the speed training at same intensity such as 70-90%.

The percentage of velocity of training for experimental groups are presented in Table I.

TABLE I

PERCENTAGE OF VELOCITY OF TRAINING FOR EXPERIMENTAL GROUPS

Sl.No	Groups	Percentage of velocity used during different weeks											
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
1.	**Low**	30	33	36	38	41	41	43	45	45	47	49	50
2.	**Medium**	70	70	70	73	73	73	75	75	75	77	79	80
3.	**High**	90	90	90	93	93	93	95	95	95	97	99	100

The analysis of dependent _t' – test on the data obtained for selected speed parameters of the pre-tests and post-tests of experimental groups and control group have been analyzed and presented in Table II.

TABLE II
THE SUMMARY OF MEAN AND DEPENDENT 't' TEST FOR THE PRE AND POST- TEST ON SELECTED SPEED PARAMETERS OF EXPERIMENTAL AND CONTROL GROUPS

Variable	Test Mean	High Velocity Group	Medium Velocity Group	Low Velocity Group	Control Group
Speed	Pre-test	7.31	7.32	7.19	7.25
	Post-test	6.79	6.93	7.04	7.26
	_t'- test	17.54*	11.42*	7.99*	0.37
Stride Length	Pre-test	1.65	1.66	1.66	1.69
	Post-test	1.75	1.74	1.71	1.69
	_t'- test	13.38*	10.33*	3.58*	0.00
Stride Frequency	Pre-test	4.16	4.12	4.23	4.08
	Post-test	4.23	4.16	4.26	4.07
	_t'- test	2.66*	3.53*	0.61	0.48

*Significant at .05 level

(Table value required for significance at .05 level with df 14 is 2.14)

The _t'- test values between the pre and post-test means of experimental groups and control group on speed were 17.54, 11.42, 7.99 and 0.37 respectively. Since the obtained _t'-test value of experimental groups are greater than the required table value 2.14 with df 14 at .05 level of confidence, it is concluded that high, medium, and low velocity resistance training followed by speed training groups had significant improvement in the performance of speed. However, control group has no significant improvement in the performance of speed. The _t'-test values between the pre and post-test means of experimental groups and control group on stride length were 13.38, 10.33,3.58 and 0.00 respectively. Since the obtained _t'-test value of experimental groups are greater than the required table value 2.14 with df 14 at .05 level of confidence, it is concluded that high, medium, and low velocity resistance training followed by speed training groups had significant improvement in the performance of stride length. However, control group has no significant improvement in the performance of stride length. The _t'-test values between the pre and post-test means of experimental groups and control group on stride frequency were 2.66, 3.53, 0.61 and 0.48 respectively. Since the obtained _t'-test value of high and medium velocity resistance training followed by speed training groups are greater than the required table value 2.14 with df 14 at .05 level of confidence. However, the obtained _t'-test value of low velocity resistance training followed by speed training and control groups are less than the required table value of 2.14 with df 14 at .05 level of confidence. It is concluded that high and medium velocity resistance training followed by speed training groups had significant improvement in the performance of stride frequency. However, low velocity resistance training followed by speed training group and control group has no significant improvement in the performance of stride frequency.

The analysis of covariance on the data obtained for selected speed parameters of the adjusted post-tests of experimental groups and control group have been analyzed and presented in Table III.

TABLE III
ANALYSIS OF COVARIANCE ON SPEED, STRIDE LENGTH AND STRIDE FREQUENCY BETWEEEN ADJUSTED POST-TEST MEANS OF EXPERIMENTAL AND CONTROL GROUPS

Variable	Adjusted post test means				Source of Variance	Sum of Squares	df	Mean Squares	'F' ratio
	High Velocity Group	Medium Velocity Group	Low Velocity Group	Control Group					
Speed	6.75	6.88	7.11	7.28	**Between** **Within**	2.49 0.77	3 55	0.83 0.01	59.04*
Stride Length	1.77	1.75	1.71	1.67	**Between** **Within**	0.08 0.08	3 55	0.03 0.001	19.06*
Stride Frequency	4.21	4.18	4.11	4.10	**Between** **Within**	0.08 0.43	3 55	0.03 0.01	3.61*

*Significant at .05 level of confidence

(The table value required for significance at .05 level with df 3 and 55 is 2.78)

The adjusted post test mean values of speed for high, medium, and low velocity resistance training followed by speed training groups and control group are 6.75, 6.88, 7.11 and 7.28 respectively. The obtained ‗F'- ratio of 59.04 for adjusted post test mean is more than the table value of 2.78 for df 3 and 55 required for significance at .05 level of confidence. The results of the study indicate that there is significant difference among the adjusted post test means of high, medium, and low velocity resistance training followed by speed training groups and control group on the development of speed. The adjusted post test mean values of stride length for high, medium, and low velocity resistance training followed by speed training groups and control group are 1.77, 1.75, 1.71 and 1.67 respectively. The obtained ‗F'- ratio of 19.06 for adjusted post test mean is more than the table value of 2.78 for df 3 and 55 required for significance at .05 level of confidence. The results of the study indicate that there is significant difference among the adjusted post test means of high, medium, and low velocity resistance training followed by speed training groups and control group on the development of stride length. The adjusted post test mean values of stride frequency for high, medium, and low velocity resistance training followed by speed training groups and control group are 4.21, 4.18, 4.11 and 4.10 respectively. The obtained ‗F'- ratio of 3.61 for adjusted post test mean is more than the table value of 2.78 for df 3 and 55 required for significance at .05 level of confidence. The results of the study indicate that there is significant difference among the adjusted post test means of high, medium, and low velocity resistance training followed by speed training groups and control group on the development of stride frequency.

The scheffe's test for the differences between the adjusted post-test paired means on selected speed parameters of experimental and control groups have been analyzed and presented in Table IV.

TABLE IV
THE SCHEFFE'S TEST FOR THE DIFFERENCES BETWEEN THE ADJUSTED POST TEST PAIRED MEANS ON SPEED, STRIDE LENGTH AND STRIDE FREQUENCY

Variable	Adjusted post test means				Mean Difference	Confidence Interval
	High Velocity Group	Medium Velocity Group	Low Velocity Group	Control Group		
Speed	6.75	6.88	---	---	0.13*	0.10
	6.75	---	7.11	---	0.36*	0.10
	6.75	---	---	7.28	0.53*	0.10
	---	6.88	7.11	---	0.23*	0.10
	---	6.88	---	7.28	0.40*	0.10
	---	---	7.11	7.28	0.17*	0.10
Stride Length	1.77	1.75	---	---	0.03*	0.03
	1.77	---	1.71	---	0.06*	0.03
	1.77	---	---	1.67	0.10*	0.03
	---	1.75	1.71	---	0.03*	0.03
	---	1.75	---	1.67	0. 07*	0.03
	---	---	1.71	1.67	0.04*	0.03
Stride Frequency	4.21	4.18	---	---	0.03	0.10
	4.21	---	4.11	---	0.10*	0.10
	4.21	---	---	4.10	0.11*	0.10
	---	4.18	4.11	---	0.07	0.10
	---	4.18	---	4.10	0.08	0.10
	---	---	4.11	4.10	0.01	0.10

*Significant at .05 level of confidence

The adjusted post test mean difference on speed between high and medium velocity resistance training followed by speed training groups, high and low velocity resistance training followed by speed training groups, high velocity resistance training followed by speed training group and control group, medium and low velocity resistance training followed by speed training groups, medium velocity resistance training followed by speed training group and control group and between low velocity resistance training followed by speed training group and control group are 0.13, 0.36, 0.53, 0.23, 0.40 and 0.17 respectively. These values are greater than the confidence interval value 0.10, which shows significant difference at .05 level of confidence. It may be concluded from the results of the study that there is a significant difference in speed between the adjusted post test means of high and medium velocity resistance training followed by speed training groups, high and low velocity resistance training followed by speed training group and high velocity resistance training followed by speed training group and control group, medium and low velocity resistance training followed by speed training groups, medium velocity resistance training followed by speed training group and control group and between low velocity resistance training followed by speed training group and control group. However, the improvement of speed was significantly higher for high velocity resistance training followed by speed training group than medium and low velocity resistance training group followed by speed training groups. It may be concluded that high velocity resistance training followed by speed training is better than the medium and low velocity resistance training followed by speed training in improving speed. The adjusted post test mean difference on stride length between high and medium velocity resistance training followed by speed training groups, high and low velocity resistance training followed by speed training groups, high velocity resistance training followed by speed training group and control group, medium and low velocity resistance training followed by speed training groups, medium velocity resistance training followed by speed training group and control group and between low velocity resistance training followed by speed training group and control group are 0.03, 0.06, 0.10, 0.03, 0.07 and 0.04 respectively. These values are greater than the confidence interval value 0.03, which shows significant difference at .05 level of confidence. It may be concluded from the results of the study that there is a significant difference in stride length between the adjusted post test means of high and medium velocity resistance training followed by speed training groups, high and low velocity resistance training followed by speed training group and high velocity resistance training followed by speed training group and control group, medium and low velocity resistance training followed by speed training groups, medium velocity resistance training followed by speed training group and control group and between low velocity resistance training followed by speed training group and control group. However, the improvement of stride length was significantly higher for high velocity resistance training followed by speed training group than medium and low velocity resistance training group followed by speed training groups. It may be concluded that high velocity resistance training followed by speed training is better than the medium and low velocity resistance training followed by speed training in improving stride length. The adjusted post test mean difference on stride frequency between high and low velocity resistance training followed by speed training groups, high velocity resistance training followed by speed training group and control group are 0.11 and 0.10 respectively. These values are greater than the confidence interval value 0.10 which shows significant difference at .05 level of confidence. It may be concluded from the results of the study that there is a significant difference in stride frequency between high and low velocity resistance training followed by speed training groups, high velocity resistance training followed by speed training group and control group. The adjusted post test mean difference in stride frequency between high and medium velocity resistance training followed by speed training groups, medium and low velocity resistance training followed by speed training groups, medium velocity resistance training followed by speed training group and control group, low velocity resistance training followed by speed training group and control group are 0.03, 0.07, 0.08 and 0.01 respectively. These values are less than the confidence interval value 0.10. It may be concluded from the results of the study that there is no significant difference exist in stride frequency between the adjusted post test means of high and medium velocity resistance training followed by speed training groups, medium and low velocity resistance training followed by speed training groups, medium velocity resistance training followed by speed training group and control group, low velocity resistance training followed by speed training group and control group. However, the improvement of stride frequency was significantly higher for high velocity resistance training followed by speed training group than medium and low velocity resistance training group followed by speed training groups. It may be concluded that high velocity resistance training followed by speed training is better than the medium and low velocity resistance training followed by speed training in improving stride frequency. These findings are in line with the findings of [13-15]. It is inferred from the results of the present study that all the dependent variables were significantly improved due to the effect of high, medium, and low velocity resistance training followed by speed training.

FINDINGS

1. Experimental groups namely high, medium and low velocity resistance training followed by speed training group had significantly improved the selected dependent variables namely speed, stride length and stride frequency when compared to the control group.

2. It is also found that the improvement caused by high velocity resistance training followed by speed training was greater when compared to the effects caused by both medium and low velocity resistance training followed by speed training.

CONCLUSION

It may be concluded that high velocity resistance training followed by speed training group is found to be better than medium and low velocity resistance training followed by speed training to increase speed, stride length and stride frequency.

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APPENDIX I
EXERCISES PRESCRIBED FOR RESISTANCE TRAINING DURING THE TRAINING PERIOD

1.	Flat Bench Press
2.	Shoulder Press
3.	Biceps Curl
4.	Back Squat
5.	Leg Press
6.	Power Clean
7.	Crunch
8.	Bent Over Row
9.	Incline Bench Press
10.	Front Squat
11.	Lunge
12.	Dead Lift
13.	Wrist Curl
14.	Leg Curl
15.	Step Up
16.	Snatch

Resistance training programme was designed as per (1RM) repetition maximum of the subject. To assess the 1RM, each subjects were tested for his maximum ability of each exercise and the percentages were calculated separately to fix the intensity as prescribed by Dan Wathen. Each training session only eight exercises were given among the above sixteen exercises.

APPENDIX II
EXERCISES PRESCRIBED FOR SPEED TRAINING DURING THE TRAINING PERIOD

SL.NO	EXERCISE	PHASE*			
		I	II	III	IV
1.	Alternative pace run 75 m – 50 m – 75 m – 50 m 75 m – 50 m 2 sets 10 min rest in between set	70 – 75 % of Intensity	76 – 80 % of Intensity	81 – 85 % of Intensity	86 – 90 % of Intensity
2.	2 x 4 x 60 m run 5 min rest in between repetitions 5 min rest in between set				
3.	Ins and out training Running course 120 m (In zone 30 m and out zone 30 m) 4 sets 5 min rest in between set				
4.	Acceleration sprint 30 m – 40 m – 60 m – 80 m 2 sets 10 min rest in between set				

* A phase consists of 3 weeks duration

Initial load was fixed according to response made at pilot study by subjects.